

FNAL/BNL Joint Study on Long Baseline Neutrinos

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Report to NuSag (5/20/2006)

- ❑ Study is jointly sponsored by BNL (S. Dawson) and FNAL (H. Montgomery)
- ❑ Study is led by Gina Rameika (FNAL) and Milind Diwan (BNL)

Study Origins

- ❑ Started with visit to BNL by FNAL management (& Gary Feldman)
 - Represents a commitment by BNL and FNAL management to work together on exploring future possibilities for long baseline neutrino experiments
 - ❑ How can we explore the neutrino mixing matrix with long baseline experiments?
 - How does the physics depend on the beam and detector characteristics?
 - What are realistic possibilities?
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Which Beam to Study?

- ❑ Initial charge discussed high intensity neutrino beam from BNL, along with a proton driver from FNAL
 - ❑ Study organizers decided to concentrate on beam from Fermilab
 - Will consider physics with a neutrino beam with upgraded intensity without proton driver (<1 MW)
 - Beam could be upgraded NuMi beam or new beamline pointed to DUSEL
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Charge to study

- Consider as a function of θ_{13} the ability to establish a finite θ_{13} , determine the mass hierarchy, and to search for CP violation using a broad band technique and an off-axis technique
 - ✓ For each measurement, what are the limiting systematic uncertainties?
 - Consider the precision with which each of the oscillation parameters can be measured
 - ✓ What is the ability to discriminate between neutrino mass concepts?
 - Consider the available experimental design concepts
 - ✓ What is the optimum proton beam energy; optimum geometry, detector technology, cost guesstimate?
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International Advisory Committee

- ❑ Franco Cervelli (INFN)
 - ❑ Milind Diwan (BNL); co-leader
 - ❑ Maury Goodman (ANL)
 - ❑ Bonnie Fleming (Yale)
 - ❑ Karsten Heeger (LBL)
 - ❑ Takaaki Kajita (Tokyo)
 - ❑ Josh Klein (Texas)
 - ❑ Steve Parke (FNAL)
 - ❑ Gina Rameika (FNAL); co-leader
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Work list for Study

☐ Detectors:

- ☐ Liquid Argon simulation studies with off-axis and wide band beam (Bonnie Fleming)
 - ☐ How deep does it need to be?
- ☐ Water Cherenkov Detector (M. Diwan)
 - ☐ Resolution and Background Reduction
 - ☐ Interface with DUSEL

☐ Beam:

- ☐ Simulations of beam spectrum to DUSEL
 - ☐ Sensitivity using 2nd off-axis detector (G. Rameika)
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Timelines

- ❑ Off-axis community is considering a follow-up experiment to Nova (G. Rameika)
 - ❑ Broad band community sees interface with DUSEL process (M. Diwan)
 - ❑ EPP2010 recommends proceeding with an international study to understand the possibilities in a worldwide context
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Goal of Study

- ❑ Preliminary report, July 15, 2006
 - ❑ Final report, October 1, 2006
 - ❑ Hope for a consensus statement of advantages/disadvantages of off-axis and broad band techniques along with a discussion of the unresolved questions
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